UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
1595 Wynkoop Street
DENVER, CO 80202-1129
Phone 800-227-8917
http://www.epa.gov/region08

April 3, 2013

Merry E. Gamper
WY 921 Physical Scientist
5353 Yellowstone
Cheyenne, WY 82007
(307)775-6272

Ms. Gamper,

The purpose of this letter is to communicate EPAs position on model applicability and use, and to provide final EPA comments regarding the *Final Numerical Groundwater Modeling Report, Interim Plan, Pinedale Anticline Project Area ROD,* dated November 2012 (the Report). The first section of the letter details EPA's position on the model's applicability and use. The second section details additional modifications that are recommended prior to the final release of the Report.

MODEL APPLICABILITY AND USE:

As with many groundwater flow and solute transport models, the model constructed for the Pinedale Anticline Project Area (PAPA) required many assumptions and simplifications, and the development of alternative models has been limited by the original scope of the project as stated by AMEC and the Operators. Although Section 7.0 of the Report acknowledges that "*Models are simplifications of complex systems*" and details some of the major limitations of the groundwater flow and solute transport model, it is recommended that the following limitations be considered when determining future model applicability and use:

- Low density of hydrogeologic data: Much of the model area has been characterized by lithologic information collected along the axis of the Pinedale Anticline, with substantially lower data density along the fringes of the PAPA. In addition, a significant amount of data was derived from borings completed for purposes other than characterizing the hydrogeology of the Wasatch formation and shallower alluvium. The biased data creates a significant amount of uncertainty regarding the regional and local structure and the associated groundwater flow regime.
- Assumption that Faults or Fractures are not present in the Wasatch Formation: The Report states: "*Limited information is available regarding the location of fractures and faults in the Wasatch Formation, and no information is available regarding hydraulic properties of fractures and faults. Fractures and faults can act as both conduits and barriers to flow and contaminant transport. For this reason, the model assumes that groundwater flows through a porous medium and that no preferential flow occurs through fractures in the Wasatch Formation. In reality, some preferential flow paths associated with geologic structure and secondary porosity likely exist; permeable fractures could affect groundwater flow directions and transport velocities.*" The possibility that secondary porosity exists and has a strong affect on groundwater flow is a significant unknown. The presence of secondary porosity could lead to dramatically different results than those simulated by the model.
- Inability to simulate perched groundwater: The Report describes how the Wasatch Formation is not continuously saturated and that some perched groundwater systems discharge to springs. As designed, the model is unable to simulate perched groundwater systems. The migration of contaminants in areas of perched groundwater could be significantly different from what the model currently predicts. Perched groundwater might move faster (or slower) than groundwater in the fully saturated Wasatch Formation and could discharge to surface receptors not

represented by the groundwater flow and solute transport model (e.g. springs and other ephemeral or perennial surface water features).

- Groundwater and surface water flow conditions based on average base flow conditions: The Report states in Section 2.5: "*The steady-state groundwater balance is based on annual average conditions except for base flow to streams; base flow to streams is based on November conditions, because this month is representative of average base flow conditions (i.e., after the irrigation season and the runoff period).*" It should be recognized that a steady-state flow model based on a combination of average and base flow conditions is not likely to provide an accurate simulation of groundwater flow and solute transport conditions at any particular time. Groundwater flow during wet periods, dry periods, periods of high runoff, or during the irrigation season may be altered significantly and may affect local horizontal and vertical flow gradients. In addition, average and base flow conditions used to calibrate the model derived from data collected from 2009 to 2011 may or may not be representative of future climatic conditions.
- Model grid size: The model grid size ranges from 300 to 2,006 feet. Lithologic heterogeneities on scales smaller than the grid sizes and layer thicknesses will not be accurately represented. As a result, spills or releases that occur on a scale smaller than local grid size may not be accurately simulated.

Based on the limitations stated above, the applicability and use of this model should be carefully considered in the future. The model will only be appropriate for use in specific scenarios and the model output should only be considered an estimate. Professional judgment, expertise, and other appropriate factors should always be considered. The Agencies (BLM, WY DEQ, and EPA) should reserve the right to assess the model relevance and determine the model's appropriateness for a given scenario. During the drafting of the Mitigation Measures Report and the Draft Final Groundwater/Aquifer Pollution Prevention, Mitigation and Monitoring Plan, sensitive zones identified in Figure 30 (and other figures) of the Report can be used to assist in the selection of monitoring points. However, potentially sensitive zones identified by the model cannot be used to definitively eliminate other areas of the PAPA where professional judgment and expertise suggest additional monitoring would be beneficial.

FINAL SPECIFIC RECOMMENDATIONS:

Below are additional specific comments that the Report would benefit from addressing prior to final release.

1. Section 4.1 – Steady State Calibration. The Report discusses the use and exclusion of head targets. The Report would benefit from more clearly stating the rationale and trigger for removing outliers. In addition, the Report would benefit from more clearly explaining how many head targets were excluded. The first paragraph of the section states: "*Of the 109 wells, one well was outside the model boundary and 11 wells had water levels that were anomalous (varying by more than 30 feet from water levels in nearby wells).*" In the third paragraph of the section, the Report states: "*In September 2010, 92 water elevations were measured, and 69 of these were used as head targets. Of the 23 water level elevations measured in 2010 that were not used, 13 were anomalous, one was measured outside of the model domain, and 9 were measured at surface water sites.*" Based on the first paragraph and one groundwater level gauging event in 2010, it is unclear how 13 anomalous water levels could have been collected from 11 wells. Please clarify this section and ensure number agreement in the Report.
2. Section 2.3.2.1 – Groundwater Gradients and Average Velocity. The Report provides vertical hydraulic gradients in percent. Vertical gradients are universally reported as dimensionless or as feet/feet. Please provide vertical gradients in the same form that horizontal gradients are provided in the Report.
3. Section 2.4 – Aquifer Properties. During the first round of comments, the EPA provided the following comment: "*The Report discusses the lack of drawdown in observation wells during the pump tests. Was this lack of observed drawdown perhaps a result of higher permeability, pumping rate, or differences in screened intervals?*" AMEC provided the following response: "*The lack of drawdown could be a result of all of these. It may also be the result of low permeability material separating the two well screens.*" Please integrate this response into Section

2.4 so that all possible reasons for lack of drawdown response during the pump tests are clearly presented.

4. Section 6.1.1 – Methods. For future particle tracking simulations, it is recommended that more than one particle be used for each starting or termination cell.
5. Appendix I – Solute Transport Parameterization. The appendix should provide a table that presents all solute transport parameters. Although the parameters are provided in the text, they should also be presented in a table.

If you have questions or concerns, please do not hesitate to contact me at (303) 312-6283, or by email: schmidt.andrew@epa.gov.

Sincerely,

Andrew P. Schmidt, P.G.
Regional Superfund Hydrogeologist
8EPR-S